

COLOR FILTER MANUFACTURING METHOD FOR A PLASTIC SUBSTRATE

Background of the Invention

5 1. Field of the Invention

The present invention relates to a color filter manufacturing method for a plastic substrate. More particularly, it uses an inkjet printing method to jet photo resists into the groove of the plastic
10 substrate.

2. Description of the Prior Art

Liquid crystal displays have the advantages of small volume, light weight, low power consumption,
15 low radiation, excellent image quality, broad applications, and are widely applied in the consumer electronic products or computer products, such as medium to small portable TVs, mobile phones, camcorders, notebook computers,
20 desktop computers and projection TVs, etc. More particularly, the main stream of LCD is using in flat panel display system. The key component for presenting better brightness, vividness, and color-ness in liquid crystal displays is in the color

filter. Therefore, the color filter has a full potential in the LCD development. The biggest market of the color filter is in notebook industry. More particularly, it focuses on the color filter with big-area, low pollution, and low cost characters. The main stream of the conventional color filter manufacture is to implement the lithography process. It mainly comprises three steps: One is coating for three primary colors of R. G. and B photo-resists. Another step is proximity alignment exposure. The other step is development. Among the steps, the development of the photo-resist coating technique is paid for more attention, such on the rotational coating method. However, the shortage of the conventionally rotational coating method has a low usage in materials, which is about 1 to 2%. More, it also needs more CF processes thereto cause more wearing damages and increase more contacting chances with chemical liquids.

Another coating technique is provided by Dai Nippon Printing DNP. The color filter is manufactured by inkjet printing method applying on the glass substrate. The method overcomes the

low rate of using materials while using the rotational coating method. However, it needs to do bank between the photo-resists for against color mixing in photo-resists, and the bank needs to be
5 formed while doing CF process. Further, the used chemical liquids in the process easily cause damage on the substrate. More, photo-resist is directly printing on the surface of the substrate thereto the surface tension is less than the
10 cohesive force. It, therefore, has a worse coating character.

Summary of the Invention

In order to overcome the shortages of the current color filter manufacturing method, the
15 present invention is to provide a color filter manufacturing method for a plastic substrate. More particularly, the method is applied to the plastic substrate. The plastic substrate potentially stand less chemical corrosion than the glass
20 substrate, and therefore, the conventional CF process of manufacturing color filters needs to be processed in many times with chemical liquids. Apart from above, it causes damages on the plastic substrate thereto influence the quality of

the color filter. As a result, it needs to choose the chemical liquid of which is with less corrosion character to do CF process while using the plastic substrate to manufacture a color filter. However, 5 the manufacturing cost is increased herein. The present invention for overcoming the problem is therefore, to provide a technique applying to the plastic substrate without processing many CF processes to implement a color filter. The method 10 uses a re-molding technique to form a plastic substrate with multiple grooves. Then, it uses the inkjet printing method to jet three primary colors into the grooves of the above saying substrate.

Further, it processes coating on the plane 15 layer. The feature of the process is that the substrate is one-piece to be formed thereto implement a big-area filter. Also, it does not need to use CF process thereto avoid any damages from using chemical liquids and decrease 20 environmental pollution. Another method is that the photo-resist jetted into the groove, and therefore, solves the coating problem caused from the surface tension by the inkjet printing method. The present invention can fully implement the

purpose of manufacturing color filter based on achieving a simple manufacture and a low cost.

Brief description of the Drawings

5 Figure 1 is a 3-D graph of the present invention showing a master mold;

 Figure 2a is an example of the present invention showing a substrate by using a master mold in Figure 1 to do extrusion;

10 Figure 2b is a 3-D graph showing the substrate formed from Figure 2a;

 Figure 3 is an example of the present invention showing the groove of the substrate where the color photo-resist is jetted;

15 Figure 4a is one of the preferred embodiments showing a plastic substrate filled with color photo-resists according to the present invention;

 Figure 4b is another preferred embodiment of the present invention showing a plastic substrate
20 filled with color photo-resists;

 Figure 5 is an example of the present invention showing the plastic substrate in Figure 4b additionally filled with the black photo-resist;

 Figure 6 is an example of the present

invention showing a passivation layer formed on the surface of the plastic substrate referring to Figure 5;

Figure 7 is another preferred embodiment of the present invention showing the substrate having a groove set on the bottom of the substrate and filled with the black photo-resists;

Figure 8 is an example of the present invention showing the passivation layer covered on the substrate and the black photo-resist covered on the groove in Figure 7;

Figure 9 is another 3-D graph showing the substrate according to the present invention;

Figure 10 is an example of the color filter based on Figure 9, wherein the black photo-resist covers on the top surface of the substrate; and

Figure 11 is an example of the color filter based on Figure 9, wherein the black photo-resist covers on the bottom surface of the substrate.

Detailed Description of the Preferred Embodiments

One of the color filter manufacturing methods for a plastic substrate according to the present

invention uses a re-molding technique to form the plastic substrate. The master mold of the re-molding plastic substrate uses etching and electrolating techniques of LIGA
5 LithographieGaVanoformung Abformung to implement. The LIGA technique defines the required graphs by the micro-development. Then, it processes the steps of electro-deposition, electroforming, and electrolating to perform the
10 etching. Finally, it processes a micro molding and a micro-injection molding to form the master mold 10 in at least three-bump areas 101, 102, and 103 as shown in Figure 1.

The steps of the color filter manufacturing
15 method for a plastic substrate according to the present invention can be described below. First, please referring to Figure 2a, it uses three-bump areas 101, 102, and 103 of the master mold 10 to extrude a substrate 20. The substrate is with three
20 corresponding grooves 21, 22 and 23 as shown in Figure 2b. Then, the three grooves 21, 22 and 23 of the substrate are filled with three primary colors of R. 31 G. 32 and B 33 photo-resists in order by using the inkjet printing method as shown

in Figure 3.

As shown in Figure 4, the photo-resists 31, 32 and 33 in the above saying groove bring the surface tension thereto form an arc surface 34 in the surface of the photo-resist which is higher than the substrate 20. In order to overcome the problem, the side of the groove in the plastic substrate can be formed as a rough surface, for example, the surface with multiple pits. Therefore, it can decrease the protruding heights of the photo-resists 31, 32, and 33 after molding. Then, the topside forms as a plane surface 35 as shown in Figure 4b.

The consequent step of a color filter manufacturing method for a plastic substrate according to the present invention can be seen in Figure 5. The black photo-resist 50 is similarly jetted into the gaps of the photo-resists 31, 32 and 33 by using the inkjet printing method. Finally, the top of the above saying photo-resists 31, 32 and 33 is covered with a passivation layer 40 as shown in Figure 6 for implementing a so-called color filter manufacture of the present invention. The present invention can divide it as two types,

which are the transparent type and the reflective type.

According to the color filter manufacturing method for a plastic substrate as mentioned above
5 for the present invention, the black photo-resist 50 is disposed on the same side of the protruding side in each color photo-resist 31, 32 or 33 as shown in Figure 5 and Figure 6. Another preferred embodiment of the present invention sets the
10 black photo-resist on the opposite side of protruding side in above saying photo-resists 31, 32, and 33. As can be seen in Figure 7, the bottom of the substrate 30 forms multiple grooves 36. The multiple grooves 36 are placed on the
15 bottom of the substrate 30 corresponding to the gaps of photo-resists 31, 32 and 33. According to the molding method by using the above saying black photo-resist, the groove 36 is filled with the black photo-resist 51 from jetting. Further, the
20 passivation layer 41 is filling on the gap of the color photo-resists 31, 32, and 33 in the top surface of the substrate 30 as shown in Figure 8.

Apart from the application mentioned above for the present invention using in either a

reflective or a transparent color filter, it also can apply to the transflective filter in the productions. A shown in Figure 9, the master mold has been changed from its structure to extrude a plastic substrate 60 with different heights of the grooves. Each groove 61, 62, or 63 of the plastic substrate 60 has another bump 61, 621, or 631. Then, it repeats the above saying step of the photo-resist jetting according to the present invention. Each groove 62, 62, or 63 of the substrate 60 forms different color photo-resists 31", 32", and 33" and the black photo-resist 52 and the passivation layer 42 fill around as shown in Figure 11. The bottoms of the above saying grooves 62, 62, and 63 form different ranges of heights. Therefore, while the light penetrating to each photo-resist 31", 32" or 33, different levels of reflective effects are occurred. Also, a transflective type color filter is formed. The transflective type color filter often uses on the mobile phone, the outdoor advertising display. The surrounding luminance is always changing but still needs to be required with a clear identify ability.

Please referring to Figure 11, the black

photo-resist 53 is formed on the bottom of the substrate 60' based on the technique of Figure 8 as shown in Figure 12.

According to the above description, the present invention relates to a color filter manufacturing method for a plastic substrate, which wholly meets the improvement. Also, the present invention meets novelty, and therefore, is applicable to the industry.

Although the present invention has been described in detail with respect to alternate embodiments, various changes and modifications may be suggested to one skilled in the art, and it should be understood that various changes, suggestions, and alternations can be made hereto without departing from the spirit and scope of the invention as defined by the appended claims.